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fact we offer an interpretation. Since the pictures admit of different interpretations they must be examined in the light of the physical properties of protoplasm. To have perceived and applied this postulate is the unperishable contribution of Bütschli.

Accordingly nucleus and protoplasm are thoroughly examined in their physical and chemical relations, and the manifold structural forms assumed under the microscope are partially explained by considering protoplasm a very soft gel, near the critical condition. "Under various abnormal or perhaps physiological conditions it may wholly or in part become a sol."

Two lectures are devoted to cell division, and like all other parts of the book, they are illustrated with large, clear, beautifully executed figures, derived from many sources. Collectively they suggest faultless technique and the clearest of objectives. The account of mitosis imparts the fascination which this process still holds upon the lecturer through its inherent mystery, and the subject is left with the following characteristic conclusion:

Why the number of chromosomes and their size are so very different in closely related species or races; why specially in the seminal cells of one representative of the cyclostomes (*Myxine*) peculiarly formed rod-shaped centrosomes appear; why the centrosomes of a particular annelid (*Rhynchelmis*) attain enormous, macroscopically visible dimensions, etc.; these all are problems the rational explanation of which can not be hoped for in the years within sight.

The course continues with a consideration of the following themes: Growth; the substratum of inheritance; shape and structure; the histology of metabolism; change of form and motion; the nervous system; and finally, the possibility of establishing histological laws. Each of these subjects is treated in one or more lectures, with freshness and originality. The two lectures on "shape and structure" state that the adult is characterized by relatively stabile weight and fixed shape, and this condition is attributed to "the high degree of elasticity in the adult organism as contrasted with the plasticity of embryonic stages." The structures accounting for these characteristics

of the adult are then considered—epithelium and its modifications in the first lecture, with the conclusion that "in maintaining the typical shape of the organism, epithelial tissue as such plays a subordinate rôle"; and connective tissue, with cartilage and bone, in the second lecture.

As a whole the lectures are to be highly commended. Their unsolved riddles may perhaps suggest to others, as to the reviewer, the difficulties of Carlyle's *Teufelsdröckh*, but much is in store for the English readers who "accompany him through all his speculations." Of inconsistencies we have noted only one, and can not decide which of the following propositions is correct:

Histological investigation is seldom or only exceptionally able to take the lead over other methods of investigation as a pioneer in unknown lands (p. 11).

Histology belongs essentially to the sciences of discovery, so that histological discoveries have often, or very generally, the same exploratory character as the voyages of the early mariners (p. 4).

FREDERIC T. LEWIS

Flies in Relation to Disease—Bloodsucking Flies. By EDWARD HINDLE, B.A., Ph.D. Cambridge University Press, 1914.

This volume is one of the Cambridge Public Health series and complements the recent work on flies in relation to disease by Dr. G. S. Graham-Smith. It was written in collaboration with the distinguished investigator, Major S. R. Christophers, who, for reasons stated in the preface, did not consent to appear as joint author. In its preparation the author was also guided by Professor G. F. H. Nuttall. It is therefore to be supposed that it measures up to the standard set by the noted Quick Professor of Protozoology in Cambridge University. The reader will find as he proceeds through the work that this is the case.

Dr. Hindle's volume deals with the most important field in medical entomology at the present time as its scope includes the treatment of species transmitting such important maladies as malaria, yellow fever, sleeping sickness and others. In this field much activity

has been displayed in recent years. Most of the European nations which have possessions in Africa have sent scientific expeditions to that continent to study the insect-borne diseases. In the case of England, the Royal Society, the Imperial Bureau of Entomology, and the great schools of tropical medicine have sent such expeditions. As there has been an urgent demand from administrative officers and others for early information on the subject of African insect-borne diseases, many of the commissions and investigators have published preliminary or progress reports from time to time. The undertaking of the author of this book was to summarize and correlate as far as possible the findings of the different investigators which in many cases have not been harmonious. Dr. Hindle himself has conducted investigations in various parts of Africa and adds his own views to those of other investigators on points which are by no means settled.

The general plan of the work is to combine the necessary entomological and medical features of the problem so that the accounts of the different diseases will be complete. In the treatment of diseases borne by mosquitoes, for instance, a full discussion of the classification of the mosquitoes is given. This is followed by a series of chapters on the diseases such as malaria and yellow fever which these insects transmit. The completeness of the work may be judged from the table of the two hundred and forty-one species of anopheles, their classification and generic synonymy, and notes on their habitat and connection with malaria. Even with such complete special discussions the work is well balanced, but its chief characteristic is its inclusiveness and the good judgment the author has displayed in the exclusion of immaterial details.

Dr. Hindle lost his life in military operations in Africa, where he was continuing his investigations of tropical diseases, soon after the outbreak of the war. He was a young man and would undoubtedly have made further valuable contributions to the study of insect-borne diseases. But the present book may be considered a monument that will mark his place, which was an important one in the study

of tropical diseases at a time when such work as his was much needed. W. D. HUNTER

SPECIAL ARTICLES

THE DIFFUSION OF GASES AT LOW PRESSURES MADE VISIBLE BY COLOR EFFECTS

AN interesting and instructive experiment for the lecture table is to connect a discharge tube *AC*, which is about one meter or more in length and which has the exhaust nipple at one end, to a pump that will give a Geissler vacuum—an oil Geryk pump will answer very well. Between the pump connection *M* and the valve *O* that closes the tube there should be fused a side branch *N* also having a valve. Connect *N* by a rubber tube to some source of gas other than air, *e. g.*, ordinary illuminating gas. The connection at *M* should be made direct to the pump. Connect *A* and *C* to the terminals of an induction coil that will give a spark in air five or more centimeters long.

To operate, close the valve in the branch *N*, open *O* and evacuate the discharge tube to the point where on sparking the characteristic striæ show distinctly. It is immaterial whether *A* or *C* is the cathode, or whether the discharge is unidirectional. Now close the valve *O*, and, with the pump still running, open *N* partly, allowing illuminating gas to be drawn by the pump through the branch *OM*, thus displacing the air by the gas. By closing *N*, pumping and later admitting more gas, every trace of air may be washed out of

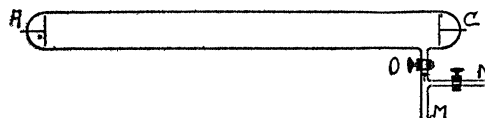


FIG. 1.

the tube leading up to *O*. Now with *N* closed allow the pump to run for a few seconds until it is judged that the pressure in the connecting tube *MO* is about that in the discharge tube *AC*.

At this stage everything is in readiness for the experiment, namely, the diffusion of gases at low pressures made visible by the color effect. The well-known characteristic color of the discharge in the case of residual air, con-